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Purchasing popular purebreds: Investigating the influence of breed-type on the pre-purchase attitudes and behaviour of dog owners

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Abstract

How and why dog owners select a specific breed may impact upon the health of the dog they acquire, and upon the wider health of the breed they select. Brachycephalic breeds are rapidly increasing in popularity despite increasing evidence linking brachycephalism with chronic and severe health conditions. This study used a questionnaire to explore pre-, during and post-purchase behaviours and attitudes of dog-owners who own popular brachycephalic dog breeds (n = breeds) compared to popular non-brachycephalic dog breeds (n = breeds). The survey received 1,427 valid responses. Brachycephalic breed owners were younger, more likely to live with children, and to be buying their chosen breed for the first time. The factor that most highly influenced brachycephalic owners decisions to buy their breed was appearance, followed by breed size suited to lifestyle, good dog breed for children and good companion breed. Perceived health of the breed was less influential in decision-making for brachycephalic owners compared to non-brachycephalic owners. The way in which owners acquired their dog differed by breed type, with brachycephalic owners more likely to use puppy-selling websites to find their dog, less likely to see either parent of their puppy, and less likely to ask to see any health records. Despite many brachycephalic breed health issues being directly related to conformation, appearance remains the most significant determinant in why people desire these breeds. More targeted educational interventions are needed to change buyer attitudes and, if ineffective, other more direct mechanisms (eg legislation) may be required to protect canine welfare.

Keywords: Animal Welfare, Brachycephalic, Companion Animal, Inherited Disorders, Pedigree, Pet Ownership

Introduction

Contemporary estimations of the domestic dog (*Canis familiaris*) population of the United Kingdom (UK) place it at around 10.5 million (Murray et al. 2010), approximately 75-80% of which are estimated to be purebred (Asher et al. 2011; O'Neill et al. 2014). The process of selecting for breed-specific characteristics in purebred dogs has been identified as having the potential to reduce dog welfare (Rooney & Sargan 2010), with strong links between breed standards and inherited diseases in the top 50 UK Kennel Club breeds (Asher et al. 2009). In addition, reduced genotypic variation within these same breeds substantially increases the prevalence of genetic disease (Summers et al. 2010). Public concerns regarding purebred dog breeding have resulted in a number of high profile reports to address the welfare concerns that have arisen as a result of the selective breeding of dogs (Associate Parliamentary group on Animal Welfare 2010; Bateson 2010).

Humans have a large appetite for variety in the appearance and behaviour of dogs, with 216 breeds currently recognised by the UK Kennel Club (The Kennel Club, 2015) Breed popularity within the dog population has remained largely stable, but with substantial, and often culturally driven, surges in the popularity of specific breeds (Herzog et al. 2004). Social influence (fashion) is the primary influence on the popularity of companion dog breeds, which is often related to media exposure e.g. featuring in movies (Herzog 2006, Ghirlanda et al 2014). Both in the United States of America (USA) and the UK, breed popularity appears to lack direct associations with functional traits (e.g. health, trainability) (Herzog 2006, Ghirlanda et al 2013) whilst displaying a concerning tendency for more popular breeds to have greater numbers of

inherited disorders (Ghirlanda et al. 2013). Increased demand may, therefore, place pressure on breeders to provide more individuals from a genetically constrained breeding population. In turn this demand will increase the number of extant recessive disorders being expressed. With regards to the appearance of popular breeds, if demand is based on the extreme appearance of certain breeds, this may result in higher levels of conformation-related disorders in the canine population.

Evidence suggests that brachycephalic (BC) (short-muzzled) breeds in particular, such as the Pug, French Bulldog and Bulldog have shown substantial increases in numbers in the UK over the past decade (The Kennel Club 2016a). Herzog (2006) suggests that breed popularity, once established, may persist for a decade or more, indicating that BC dog populations will grow, or are unlikely to decline, in the foreseeable future. Brachycephaly has been linked with a variety of inherited diseases including respiratory disorders (Brachycephalic Obstructive Airway Syndrome; BOAS) (Packer et al. 2015a), ophthalmic disease (Packer et al. 2015b) and results in reduced lifespan compared to non-BC breeds (O'Neill et al. 2015). These conformational issues have previously led veterinarians to express concerns about the continued breeding of BC dogs (Farrow et al. 2014), with calls to out-cross or even ban certain breeds (Packer et al 2014).

Little information exists on how and why prospective companion animal owners make decisions around the purchase of purebred dogs. Pre-purchase decisions will be guided by a number of factors, although these may not be entirely predictable (Ghirlanda et al. 2013). In a study of the ideal Australian companion dog, behavioural and physical factors identified as

important included being medium sized, short haired, safe with children, friendly, obedient and healthy (King et al 2009). Owner characteristics relevant to decision-making have not been fully investigated, and may include sociodemographic factors (e.g. income, level of education, marital status), social influences (e.g. current breed popularity, celebrity endoresement) and historical influences (e.g. previous dog ownership, childhood dog ownership). External factors, such as access to breed health information may also influence decisions. The processes by which decisions are made during the acquisition of a companion animal are likely to be important at both an individual level (i.e. the health of the dog acquired) and at a population level (e.g. which types of dog and health characteristics are 'in demand'). Understanding this process will allow prospective owners to be better targeted with information, thus improving matching between households and their companion animals and allowing alternative, potentially healthier breed choices to be promoted.

This research aims to explore differences in owner characteristics, motivations for acquisition, pre- and post-purchase behaviours between owners of BC and non-brachycephalic (non-BC) breeds within the 2014 top 10 Kennel Club registered pedigrees (The Kennel Club 2016a).

Methods

Questionnaire design and dissemination

The questionnaire was designed iteratively amongst the authors and a small number of pilot respondents to ensure ease of understanding and comprehensiveness of scope. In general sections included:

1. General owner demographics e.g. gender; age; dependants; house type; income and education level; first time dog owner; first time breed owner;
2. General information on their dog e.g. signalment; age at acquisition;
3. Pre-purchase motivations: e.g. factors that influenced purchase/acquisition of their specific breed (dog appearance; breed popularity; previous breed experience; celebrity endorsement; companionship; cost);
4. Pre-purchase knowledge and behaviours e.g. Research conducted on their breed of choice prior to acquisition of their dog, the amount of time spent considering acquisition of their dog;
5. Acquisition behaviours e.g. Where and how their dog was acquired, which parents of their puppy were seen (if any), requests for health records;
6. Post-purchase attitudes e.g. Things they would change about the acquisition of their dog if they could go back in time, whether they would recommend their breed, and whether they plan to breed from their dog

Participants

Owners of the top ten registered Kennel Club (KC) pedigrees of 2014 (1. Labrador Retriever; 2 Cocker Spaniel; 3 English Springer Spaniel; 4 French Bulldog; 5 Pug; 6. German Shepherd Dog; 7 Golden Retriever; 8 Border Terrier; 9 Bulldog; 10 Miniature Schnauzer) were purposively sampled via online forums and social media platforms as well as KC breed health coordinators (BHCs). An explanatory letter was also sent to the administrators of dog-related

147 social media sites seeking permission to engage their online users. Following granting of
148 permission potential respondents were provided with a link to an online questionnaire hosted
149 on SurveyMonkey© (www.surveymonkey.com).

150

151 All participants were required to live in the UK, be 18 years of age or older and own one of the
152 eligible breeds. Respondents were informed of the aims of the project and that submission of
153 the survey would implicitly consent to the usage of their data for research purposes. Participants
154 with more than one dog fitting the inclusion criteria were requested to answer the survey in
155 regard to the one most recently acquired. This survey was approved by the Royal (Dick) School
156 of Veterinary Studies Student Survey Overview Group.

157
158 ***Statistical analyses***

159

160 Data analysis was carried out in IBM SPSS Statistics v21 (SPSS Inc, Chicago, IL, USA). Of
161 the 10 breeds three were characterised as BC (French Bulldog, Pug and Bulldog) with the other
162 seven being non-BC. Associations between breed-type (BC vs. non-BC) and variables related
163 to owner demographics, pre-purchasing, purchasing and post-purchasing behaviour were
164 explored using Chi-squared tests for categorical variables and Mann-Whitney U tests for non-
165 normally distributed continuous data (with data distribution ascertained by visual inspection of
166 histograms) or ordinal data (e.g. how influential a factor was in the decision to choose a breed
167 on a scale of 0-4). Correction factors were used to control for Type I errors introduced by
168 multiple univariate comparisons. For this, the False Discovery Rate (FDR) (Benjamini &
169 Hochberg 1995) set at 0.05 was used to take into account the number of statistical tests

performed in the univariate analyses, and all p values are presented in their raw form and FDR-corrected forms. A binary logistic regression model was used to determine which factors most influenced the purchase of BC vs. non-BC dogs (binary outcome measure). Factors with liberal associations in univariable tests ($P < 0.2$) were taken forward for multivariable evaluation. Model development used backwards stepwise elimination and the Hosmer-Lemeshow test statistic was used to evaluate model fit.

Results

Data were collected between June and July 2015. The survey received 1910 responses, of which 1427 responses were complete and valid for inclusion. Between one and two hundred responses were received for each breed: Labrador Retriever (LR, n=156), Cocker Spaniel (CS, n=199), English Springer Spaniel (ESS, n=200), French Bulldog (FB, n=143), Pug (P, n=127), German Shepherd Dog (GSD, n=115), Golden Retriever (GR, n=110), Border Terrier (BT, n=146), Bulldog (B, n=114), Miniature Schnauzer (MS, n=117). Based on breed (FB, B, P), around one quarter (N = 384/1427; 26.9%) of dogs in the sample were classed as BC with the remainder being non-BC.

Canine demographics

Over half of all dogs were male (56.9%) and the most common age was 2-4 years (38.3%) followed by 1 year or less (26.7%). There was no association between sex of the dog and skull shape (P = 0.972; P-adjusted = 0.972); however, there was an association between the age of

193 the dog and skull shape, with BC dogs younger than non-BC dogs e.g. 33.1% of BCs were 1
194 year or less vs. 24.4% of non-BCs (X^2 = 38.54, P < 0.001; P-adjusted <0.001) (Table 1). The
195 majority of dogs were neutered (43.5%) with a further 18.0% planned to be neutered in the
196 future. A higher proportion of BC dogs were entire compared to non-BC dogs (49.8% vs.
197 34.2% respectively, X^2 = 41.11, P < 0.001; P-adjusted <0.001). BC dogs had been owned for a
198 significantly shorter length of time than non-BC dogs (BC median: 21 months (25th-75th
199 percentile: 10.0-33.6) vs. non-BC dogs, median: 24 months (25th-75th percentile: 10.0-58.0),
200 MW=194135.5, P<0.001, P-adjusted <0.001)
201 [Table 1]
202
203 ***Owner demographics***
204
205 The majority of owners were female (88.5%), with no difference in sex distribution between
206 BC and non-BC owners (P = 0.148; P-adjusted = 0.187). The most common age group of
207 owners was 45-54 years (29.1%) followed by 35-44 (24.1%) and 25-34 (18.4%). Owners of
208 BC dogs were significantly younger than non-BC owners, with 13.3% of BC owners aged 18-
209 24 years old vs. 5.2% of non-BC owners, and 27.9% of BC owners aged 25-34 years old vs.
210 15.0% if non-BC owners (X^2 = 93.70; P < 0.001 P-adjusted = 0.0027). Of the respondents,
211 84.3% had attended higher education, with 15.3% attending secondary education, with no
212 difference between BC and non-BC owners (P = 0.311; P-adjusted = 0.373). The most common
213 household income bracket was £35,000-£49,999 (21.0%), followed by less than £25,000
214 (17.0%) and £50,000-£74,999 (16.4%) with no difference in income between BC and non-BC
215 owners (P = 0.450; P-adjusted = 0.511). The majority of owners lived in a house (92.0%), with

7.8% in a flat/apartment, with BC owners more likely to live in a flat/apartment (BC = 15.6% vs. non-BC = 5.0%; $X^2 = 44.55$; $P < 0.001$; P-adjusted = 0.0027). Children did not live in the majority of respondents' homes (71.3%), with the owners of BC dogs more likely to live with children than non-BC owners (BC = 34.6% with children vs. Non-BC = 26.6%; $X^2 = 8.94$; $P = 0.003$; P-adjusted = 0.0069).

Over three quarters of respondents (77.3%) had owned a dog before, with 22.6% being first time dog owners. Around half of respondents (51.8%) had not previously owned the breed of dog for which they were answering. After FDR-correction, there was no difference in the proportion of BC vs. non-BC owners that were first time dog owners (BC = 26.0% vs. non-BC = 21.4%; $X^2 = 6.29$; $P = 0.043$; P-adjusted = 0.0712); however, BC owners were more likely to be owning that breed for the first time (BC = 64.8% vs. non-BC = 47.0%; $X^2 = 37.05$; $P < 0.001$; P-adjusted=0.0027).

Pre-purchase behaviour

The majority of owners stated that they carried out some pre-purchase research before acquiring their dog (84.3%); however 15.7% (n = 207) admitted that they had carried out no research. Of the owners who stated they were first time dog owners (n = 398), there was no difference in the proportion of owners carrying out pre-purchase research between BC and non-BC owners (94.9% vs. 92.0%; $P = 0.342$, P-adjusted = 0.4004). The majority of owners strongly disagreed that their dog was an 'impulse' purchase (74.3%) and that they should have spent more time considering its purchase (72.5%). Likewise, most reported that they had

thought about getting their dog for a long time (56.5%). None of the responses to these questions differed between BC and non-BC owners (Table 2). Most respondents strongly agreed that they had spent an appropriate amount of time considering the purchase of their pet (61.4%), with BC owners more strongly agreeing with this statement than non-BC owners (67.1% vs. 59.3%; $P = 0.004$).

[Table 2]

Respondents rated fifteen factors on a scale of 0-4 (from 0= no influence, to 4= heavily influenced) depending upon how much they influenced the purchase/acquisition of their breed of dog. The highest scoring factor in the overall population was 'good companion breed' (median = 4 (2-4), Table 3), followed by 'the size of the breed suited to lifestyle' (3 (3-4)), appearance (3 (3-4)) and 'good dog breed for children' (3 (0-4)). Eleven of the fifteen factors differed in how influential they were in decision making between BC and non-BC owners (Table 3), for example, appearance was rated as more influential in choosing a BC breed than a non-BC one (and the joint highest most influential factor for BC owners) ($P < 0.001$; P-adjusted <0.001), whereas the perception of the breed being a 'generally healthy breed', or a breed with long life expectancy less influential for BC compared to non-BC owners ($P < 0.001$; P-adjusted <0.001). Exercise encouragement ($P < 0.001$; P-adjusted = 0.00) and working ability ($P < 0.001$; P-adjusted <0.001) were comparatively more influential in the choice of non-BC, as opposed to BC, breeds.

[Table 3]

Of the eleven purchasing influence factors that were associated with breed type at the univariate level, nine remained significant in a logistic regression model (Table 4). Higher influence scores for four factors were significantly associated with BC dog ownership ($P < 0.001$): appearance, good dog breed for children, good companion breed, and breed size suited to lifestyle. In contrast, high influence scores for the remaining five factors were associated with non-BC dog ownership: popularity of the breed, childhood experiences, exercise encouragement, generally healthy breed and working ability. For example, every 1 point increase in influence score for the factor 'generally healthy breed' (from 0-4: no influence to heavily influenced) was associated in a 1.6 increased odds of non-BC dog ownership. In contrast, every 1 point increase for the factor 'appearance' was associated in a 0.77 decreased odds of non-BC ownership (Table 4).

[Table 4]

Purchasing behaviour

The median (25^{th}-75^{th} percentile) age (months) at acquisition was 2.25 months (2-3). A minority of dogs (n=24, 1.7%) were acquired while under the legal age of eight weeks. The median cost at purchase was £600 (£400-£900). BC dogs were significantly more expensive to purchase than non-BC dogs (BC median= £1200 (£1000-£1800) vs. non-BC £500 (£350-£700); U = 15044.5; $P < 0.001$; P-adjusted = 0.0027). The most common source of acquisition was from a KC registered breeder, with 41.6% from KC non-Assured Breeders and 13.5% from

KC Assured Breeders (Table 5). There was no significant association between the source of the dog and their skull type (X^2 = 12.50; P = 0.052; P-adjusted = 0.08).

[Table 5]

Of the 1065 dogs acquired from a breeder, the most common way of hearing of the breeder was via a puppy selling website (Champdogs, Epupz or Pets4Homes, 27.2%), followed by the Kennel Club website (22.2%) and recommendations from family/friends (18.5%). There was a significant association between where the owner heard of the breeder and the skull type of the dog they bought, with BC dog buyers more likely to find breeders from puppy websites (BC = 35.7% vs. Non-BC = 23.8%) or selling sites (BC = 5.8% vs. Non-BC = 2.6%) (X^2 = 57.90; P < 0.001; P-adjusted = 0.0027) (Figure 1).

The majority of owners met the breeder at their home or kennels (97.2%) with a minority meeting at their own home (1.2%) or at a dog show/event (0.6%). A small number of owners did not meet the breeder of their dog (n = 4, 0.4%) and a further n = 2 (0.2%) of owners met at each of the following locations: a car park, an airport, or at their vet practice. Following FDR correction, there was no difference in where the owners met the breeder between BC and non-BC dogs (BC = 95.2% vs. non-BC=98.0%; X^2 = 9.69; P = 0.046; P-adjusted = 0.0736).

Half of owners met only the mother of their dog (47.1%), 0.5% met only the father, and 44.3% met both the mother and father. A minority of owners saw neither parent of their dog (n = 72; 6.8%). Owners of BC dogs were more likely to see neither parent than non-BC dogs (BC =

12.3% vs. non-BC = 4.8%; $X^2 = 26.95$; $P < 0.001$; P-adjusted = 0.0027). The majority of owners only visited the breeder they purchased their dog from (90.6%), with half of owners visiting that breeder on more than one occasion in addition to the purchasing visit (48.9%), one quarter only once in addition to the purchasing visit (26.4%), and one quarter only visiting to purchase the dog (24.7%). There was no difference between BC and non-BC owners in whether they visited more than one breeder ($P = 0.671$, P-adjusted = 0.7002); however, BC dogs were more likely to be purchases during the first and only visit (BC = 32.4% vs. non-BC = 21.7%; $X^2 = 12.90$; $P = 0.002$; P-adjusted = 0.0048) whilst non-BC dog owners were more likely to be purchased after one or more additional visits.

The majority of owners did not join a waiting list to buy their dog (88.2%), and less than half of respondents purchased from breeders who had a lifetime returns policy (44.4%). There was no difference between BC and non-BC owners for this policy ($P = 0.123$; P-adjusted = 0.164; return policy: $P = 0.573$; P-adjusted = 0.625).

Nearly half (46.1%) of all owners did not ask to see health records for either the sire or dam, although they were available in over half of all dogs purchased (56.4%). Significantly, BC dog purchasers were less likely to ask to see the health records of both parents compared to non-BC dogs (Table 6; $P = 0.002$; P-adjusted = 0.005) and less likely to have records available for perusal when they did ask ($P < 0.001$; P-adjusted = 0.0027) when compared to non-BC purchasers. A large proportion of owners were not sure if the parents of their dog had undergone either genetic (43.3%) or other health tests (63.6%). Respondents for BC breeds were comparatively less likely to know whether their dog's parents had undergone any genetic

329 tests than non-BC respondents (P = 0.006; P-adjusted = 0.012). Following FDR-correction
330 there was no difference between BC and non-BC groups as to whether they knew if their dog's
331 parents had undergone any other (non-genetic) health testing (P = 0.043; P-adjusted = 0.0712)
332 (Table 6).
333
334 ***Post purchase attitudes***
335
336 The majority of owners would recommend their breed to a friend or family member (96.5%),
337 with no difference between BC and non-BC owners (X^2 = 0.55; P = 0.458, P-adjusted =
338 0.5133). The majority of owners would not do anything differently if they were to go back in
339 time before acquiring their dog, (84.3%); and following FDR-correction there was no
340 difference between BC and non-BC owners as to whether they would do anything differently
341 (19.5% vs. 14.3%; X^2 = 4.60; P = 0.032; P-adjusted = 0.0569). For those owners who would
342 do something differently (n = 224; 15.7%) in the process of acquiring their dog, the most
343 common reason was to change where they acquired their dog (n = 88; 39.1%), followed by
344 level of pre-purchase research (n = 79; 35.2%), the age of their dog when they acquired them
345 (n = 23; 10.1%), the breed of dog they bought (n = 20; 8.9%), and when they acquired their
346 dog (n = 15; 6.7%). There was again no difference between BC and non-BC dog owners in
347 these reasons (X^2 = 2.14; P = 0.711; P-adjusted = 0.7261). Around one tenth of dogs were
348 planned to be bred from in the future (11.6%), which was significantly higher in BC dogs
349 (17.2%) compared to non-BC dogs (9.6%; X^2 = 22.29; P < 0.001; P-adjusted < 0.001).
350
351

Discussion

Brachycephalic dogs are dramatically increasing in popularity in the UK, and our study has characterised aspects of why and how people acquire these breeds. Identifying factors that impact upon the breed choice of buyers, such as those highlighted in this study, may allow for more targeted educational interventions during the decision-making process; however, these data also suggest that such interventions may not have the desired impact. Despite the recent increase in scientific knowledge of the health consequences of brachycephalic conformations (eg Packer et al 2012, 2015a,b), several high-profile scientific reports (eg Bateson 2010; Rooney & Sargan 2010), widespread media coverage, and educational resources for prospective puppy buyers (eg UFAW 2016), purchasers of brachycephalic dogs appear to still prioritise appearance over both health and longevity. A previous study of veterinary attitudes towards tackling inherited disorders in pedigree dogs found that one of the most common suggestions to decrease disorder prevalence was to educate the public or buyers (Farrow et al 2014). It appears that improvements in brachycephalic dog welfare are unlikely to result solely from the provision of public information or from allowing market forces to dictate desirable features in brachycephalic dogs. As such, focusing efforts on both the supply and demand sides of this equation may result in greater improvements in canine health. In this regard, altering the supply of brachycephalic dogs in line with health will require fundamental changes to reduce the prevalence of conformation-related disorders. Firstly, by altering conformation (which may, in part, be facilitated by the revision of breed standards by kennel clubs) and, secondly, changing breeding practices (including the development and mandatory implementation of health testing of relevant disorders, and potentially outcrossing to achieve healthier body shapes). If kennel clubs and brachycephalic breeders are unwilling to make such

changes, and to ensure that brachycephalic breeders operating outside of kennel club registration systems are included in any changes, legislation may be the only mechanism to circumvent those purchaser decisions which lie at odds with improvements to brachycephalic dog welfare.

Who buys a brachycephalic dog and why?

Respondents to our survey who owned brachycephalic breeds were commonly found to be younger, buying their chosen breed for the first time and had no history of childhood ownership. Although it is unclear as to why this effect occurs, and further research is required, it may reflect increased media influence among younger age groups which, in turn, contributes to the popularity of certain breeds (eg their use in advertisement). The media has been identified as a stakeholder with a role to play in improving pedigree dog welfare (Rooney & Sargan, 2010) and moderating the use of BC dogs in the media has been highlighted as a way of mitigating the current high demand for these breeds. In our sample BC dogs were also significantly younger than their non-BC counterparts, this is likely a result of recent increases in popularity driving down the median age of the BC cohort.

Owners of BC breeds were more likely to be living with children at the time of the survey. It should be noted that responses only identified if people currently lived with one or more child, not whether they had independent adult children. However, BC owners were also more likely than non-BC owners to consider 'being good with children' as an influential factor in their purchasing decision than non-BC owners. Why owners may perceive BC dogs to be good with

399 children requires further exploration; however, factors such as their small size and their 'cute'
400 neotenous looks (large, round, wide-set eyes and rounded faces; Lorenz, 1971) may be
401 influential. In addition, owners' expectations of the behaviour of brachycephalic breeds are
402 likely to influence perceptions of suitability with children, and indeed, as an 'overall good
403 companion breed', another factor identified here as influencing brachycephalic ownership. The
404 breed standards of the three BC breeds explored here suggest that breeders are selecting for an
405 "affectionate nature" in the Bulldog (The Kennel Club, 2016b), a "deeply affectionate"
406 temperament in the French Bulldog (The Kennel Club, 2016c), and an "even-tempered, happy"
407 predisposition in the Pug (The Kennel Club, 2016d). These traits point towards a dog that has
408 a positive and close relationship with their owners, that is primarily a companion dog. Indeed,
409 desire for a dog with working ability was negatively associated with BC ownership. This is
410 unsurprising for the Pug and French Bulldog breeds particularly, who have historically been
411 selected for a temperament that suited a 'lap-dog' role (Noller et al, 2008). Respondents owning
412 BC breeds were also more likely to live in apartments than their counterparts, reflective of the
413 size of a dog being an important factor in breed choice. Evidence that shorter and smaller breeds
414 have become relatively popular in Australia supports the concept that people attempt to
415 purchase dogs that can fit their lifestyle niche (Teng et al 2016). Identifying and promoting
416 breeds with fewer health conditions that fit behavioural, lifestyle and trait niches could ensure
417 that owners are aware that a wide variety of dogs can fulfil their needs without the concomitant
418 health implications associated with a particular breed.
419
420 Appearance was considered highly influential in breed selection for brachycephalic dogs.
421 Although their conformation may have driven their popularity, breeding for this appearance

poses two problems. Firstly, selecting for an extreme brachycephalic appearance runs counter to dog welfare due to its association with conformation-related inherited diseases. Secondly, by prioritising appearance, insufficient selection pressure may be exerted on some traits that would improve animal welfare (McGreevy & Nicholas 1999). Concerns have been expressed that while it is still common practice to describe 'genetically disabled' and 'deformed' pets as cute, progress toward functional and healthy animals is likely be difficult (Ott 1996). Increasing consumer awareness that the appearance of brachycephalic breeds is linked with a high risk of welfare-compromising disorders remains a priority of many animal welfare charities. For example, the RSPCA initiated a campaign 'Bred for Looks - Born to Suffer', which sought an end to the breeding of dogs based on looks (RSPCA 2013). Our data suggest that, despite such actions, the purchasing of brachycephalic breeds remains predicated largely on appearance, likely at the expense of health and welfare.

A desire for a dog that encourages exercise was negatively associated with brachycephalic dog ownership. Owners of brachycephalic breeds may perceive them to be 'low maintenance' with regards to exercise. However, it is hard to separate reduced exercise requirement from reduced ability to exercise. A large proportion of brachycephalic dogs may be unable to engage in normal levels of activity due to the inherent respiratory difficulties (Packer et al 2012, 2015a; Liu et al 2016). BOAS, a chronic respiratory disorder, is prevalent in the three brachycephalic breeds explored here, with exercise intolerance one of the key clinical signs of BOAS. This suggests that some companion animal breeds have effectively become 'handicapped' by selection for appearance traits that appeal to our anthropomorphic perceptions (Serpell 2002). Here, it appears that brachycephalic dogs may have also become 'handicapped' by humans

445 selecting for (or not strongly selecting against) a disease trait that results in a dog that fits a
446 human lifestyle choice, but is not conducive to good welfare.
447
448 In contrast to BC owners, non-BC dog owners were more highly influenced by a breed being
449 perceived to be 'generally healthy'. This may coincide with their desire for a dog with good
450 working ability that provides exercise encouragement, both of which would be limited in BC
451 breeds. Recent studies indicate that breeds with more inherited disorders have been more
452 popular, rather than less popular, suggesting that health considerations have been secondary in
453 the decision to acquire dogs (Ghirlanda et al 2013). In a systematic review of inherited diseases
454 in the dog, the Pug and Bulldog were affected by more disorders related to their body shape
455 (16 each) compared with the seven non-BC breeds studied here (affected by a median of 9
456 (range: 3-15) (Asher et al, 2009). For reform to occur in the health of BC breeds, owners must
457 be aware they are consumers, and their buying choices affect dogs at a breed health level, as
458 well as individual dog level. If owners are not motivated to buy a healthy breed, then breeds
459 with inherent health problems will be perpetuated, and the motivation of breeders to tackle
460 health problems in their breed lowered. In the absence of such motivations, it is important that
461 stakeholders consider direct mechanisms to improve breed health which are not subject to
462 consumer demands.
463
464 **Purchasing a dog**
465
466 Respondents that owned brachycephalic dogs were less likely to follow recommended
467 processes (eg those embedded within the Puppy Information Pack for the BVA AWF and

RSPCA ‘Puppy Contract’) when purchasing their dog (RSPCA 2016). They were more likely to use puppy-selling websites, less likely to see either parent of their puppy, and less likely to ask for any health records. Despite few owners explicitly admitting to purchasing their dog on impulse, brachycephalic dogs were more likely to be purchased during the first and only visit to their breeder. Despite media campaigns such as ‘Where’s Mum?’ (Pup Aid 2016) that promote buyers seeing their puppy with its mother (to avoid purchasing from puppy farms), more than 1 in 10 brachycephalic owners (12.3%) saw neither of their dog’s parents, compared to 1 in 20 non-brachycephalic owners (4.8%), thus potentially perpetuating the unethical breeding of these dogs.

The lack of requests to see health records from brachycephalic owners may reduce the priority placed on health by brachycephalic breeders, by reducing demand for healthy, tested dogs. The development and mandatory implementation of health testing in brachycephalic breeds may go some way to improve health, for example functional respiratory tests introduced by the German Pug Club (Deutscher Mopsclub) (Bartels et al 2015). However, while market forces of supply and demand are not being effectively applied to canine health, breed health is unlikely to improve substantially unless breeders are intrinsically motivated to carry out health testing themselves.

Post purchase attitudes

In general, the vast majority of the respondents to the survey were content with the breed they had purchased, with relatively few citing any regrets about their dog. Most of those expressing

491 reservations did so in relation to the manner in which they purchased their dog, perhaps
492 reinforcing the need to target prospective owners with pre-purchasing guidelines. It is of value
493 to consider that the current study is only a snapshot of the owners' and their dogs' lives.
494 Postpurchase questions can only be answered relative to the experiences of the respondents so
495 far. With a median age of 20 months, the brachycephalic dogs in this population were still
496 relatively young and thus their lifetime conformationrelated disease burden may not yet be
497 realised; for example, the mean age at which brachycephalic dogs are presented to veterinarians
498 for treatment of BOAS is 3–4 years of age (Monnet 2008). The emotional and financial burden
499 of owning a dog with conformation-related disorders may have an impact upon an owner's
500 perception of the breed, and future longitudinal studies, studies of owners with older
501 brachycephalic dogs, or studies of people who have owned brachycephalic dogs in the past
502 may provide insights into whether and how their perceptions of brachycephalic dogs change as
503 a result of experience.
504
505 Our data identified that brachycephalic owners were less likely to have neutered their dog, and
506 more likely to be planning to breed from their dog in the future. This is of concern, as increased
507 breeding by younger, first-time owners could function to proliferate breed-related issues if they
508 are unaware of the health issues associated with their breed, and how to reduce the risk of them
509 occurring.
510
511 As with all self-selected survey samples, there are limitations to the data gathered. It is not
512 possible to establish a nonresponse bias or identify from which forum the majority of
513 respondents accessed the survey. What can be identified is a substantial response bias towards

514 women and those individuals with a higher education. A female response bias to surveys is
515 relatively common (Sax et al 2003) confounded by the possibility that animal-based interests
516 and occupations may also have greater proportion of women within them. The use of special
517 interest forums may have predisposed the sampling to more educated individuals, although this
518 demographic is generally more likely to respond to surveys (Goyder et al 2002).
519 Notwithstanding the limitations of the data gathered, and the associated need for some caution
520 in interpreting the results, this research provides novel data in an area of welfare concern which
521 is otherwise lacking.
522
523 **Animal welfare implications**
524
525 The motivations for the purchasing of dogs and processes by which this is implemented have
526 clear implications for the welfare of current and future generations of dogs. All popular
527 pedigree dog breeds have been found to experience some breed-related health issues and,
528 within this, BC breeds experience some of the most chronic and severe issues. This research
529 improves our understanding of pre-purchase behaviour and motivations for these high-risk
530 breeds, and may allow prospective owners who wish to purchase a BC dog to be counselled
531 more effectively on healthier alternatives, and where that is not possible, to make responsible
532 purchasing choices of brachycephalic dogs that drive improvements in breed health rather than
533 perpetuating problems. However, these data may also indicate that breed-related health
534 information alone may not be sufficient to make significant impacts on responsible breed
535 selection, with appearance still prioritised over health and longevity. If education strategies are

ineffective at reducing demand for brachycephalic breeds in the longterm, other more direct strategies controlling the supply of these breeds may be required to protect canine welfare.

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704 Table 1 Signalment of BC and non-BC groups in study sample (n=1427 dogs)

Variable	Sub-category	Brachycephalic (n=384)	Non-brachycephalic (n=1043)
Breed	Border Terrier (n=146)	0.0%	14.0%
	Bulldog (n=114)	29.7%	0.0%
	Cocker Spaniel (n=199)	0.0%	19.1%
	English Springer Spaniel (n=200)	0.0%	19.2%
	French Bulldog (n=143)	37.2%	0.0%
	German Shepherd Dog (n=115)	0.0%	11.0%
	Golden Retriever (n=110)	0.0%	10.5%
	Labrador Retriever (n=156)	0.0%	15.0%
	Miniature Schnauzer (n=117)	0.0%	11.2%
	Pug (n=127)	33.1%	0.0%
Age	1 year or less	33.1%	24.4%
	2-4 years	40.6%	37.5%
	5-7 years	13.3%	18.5%
	8 years or more	4.9%	14.5%
	Unknown	8.1%	5.2%
Sex	Female	43.2%	43.1%
	Male	56.8%	56.9%
Neuter	No	49.8%	34.2%
	No, but I plan to	22.6%	16.3%
	Yes	17.5%	49.5%

705
706

707 Table 2 Owner perception of their pre-purchase behaviour in BC and non-BC groups
708

Question	Breed type	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	X^2	P	P-adjusted
My dog was an impulse purchase	Overall	74.3	16.1	4.8	3.3	1.5	8.89	0.064	0.096
	BC	73.1	14.2	7.5	3.8	1.4			
	Non-BC	74.7	16.8	3.8	3.2	1.6			
I thought about getting my dog for a long time	Overall	4.8	4.7	7.1	26.9	56.5	8.17	0.085	0.1179
	BC	4.0	2.9	6.0	24.9	62.2			
	Non-BC	5.1	5.3	7.5	27.6	54.4			
I should have spent more time considering the purchase of my pet	Overall	72.5	17.4	7.0	1.9	1.2	2.72	0.605	0.6453
	BC	69.6	18.8	7.5	2.6	1.4			
	Non-BC	73.5	16.9	6.9	1.7	1.1			
I think I spent an appropriate amount of time considering the purchase of my pet.	Overall	3.8	1.4	6.9	26.6	61.4	15.5	0.004	0.0083
	BC	4.6	2.0	7.4	18.9	67.1			
	Non-BC	3.6	1.2	6.6	29.4	59.3			

709
710

711 Table 3 Owner ratings of how much different factors influenced their decision to purchase

712 their chosen breed with univariate statistics

713

Factor	Overall	BC	Non-BC	U	P	P-adjusted
Appearance	3 (3-4)	4 (3-4)	3 (3-4)	125511.0	<0.001	<0.001
Popularity of the breed	1 (0-2)	0 (0-1)	1 (0-2)	180982.5	0.004	0.008
Childhood experiences	0 (0-2)	0 (0-1)	0 (0-3)	199178.5	<0.001	<0.001
Good dog breed for children	3 (0-4)	3 (0-4)	3 (0-4)	145186.0	<0.001	<0.001
Good companion breed	4 (2-4)	4 (3-4)	4 (3-4)	144060.0	<0.001	<0.001
Working ability	0 (0-2)	0 (0-0)	1 (0-3)	236428.0	<0.001	<0.001
Exercise encouragement	3 (1-3)	1 (0-2)	3 (2-4)	250002.5	<0.001	<0.001
Cost	0 (0-2)	0 (0-1)	0 (0-2)	169743.5	0.147	0.187
Generally healthy breed	2 (1-3)	1 (0-2)	3 (2-3)	234561.0	<0.001	<0.001
Long life expectancy	2 (1-3)	1 (0-2)	2 (1-3)	213949.5	<0.001	<0.001
Breed size suited to lifestyle	3 (3-4)	3 (3-4)	3 (3-4)	155079.5	0.027	0.049
This breed is easy to take care of	2 (1-3)	2 (0-3)	2 (1-3)	176236.0	0.025	0.048
Recommended by a friend/family member	0 (0-2)	0 (0-2)	0 (0-2)	175181.0	0.086	0.118
Recommended by a veterinary professional	0 (0-1)	0 (0-1)	0 (0-1)	168896.0	0.300	0.369
Celebrity endorsement/ownership	0 (0-0)	0 (0-0)	0 (0-0)	159813.5	0.074	0.108

714

715

716 Table 4 Logistic regression of nine factors that significantly influenced the acquisition of BC
717 vs. non-BC breeds. Each factor is rated on a scale of 0-4 (Reference category=Non-BC
718 breed). Higher influence scores for four factors were significantly associated with BC dog
719 ownership: appearance, good dog breed for children, good companion breed, and breed size
720 suited to lifestyle.
721

Factor	B	SE	OR	95% CI (OR)	P
Appearance	-0.259	0.072	0.772	0.670-0.888	<0.001
Good dog breed for children	-0.202	0.056	0.817	0.732-0.912	<0.001
Good companion breed	-0.463	0.095	0.629	0.523-0.757	<0.001
Breed size suited to lifestyle	-0.249	0.071	0.780	0.678-0.897	<0.001
Popularity of the breed	0.173	0.069	1.189	1.039-1.360	0.012
Childhood experiences	0.238	0.063	1.269	1.120-1.437	<0.001
Exercise encouragement	0.635	0.067	1.887	1.654-2.154	<0.001
Generally healthy breed	0.472	0.068	1.603	1.404-1.831	<0.001
Working ability	0.476	0.080	1.609	1.375-1.883	<0.001

722

723

724 Table 5 Sources that dogs were acquired from in the study population

725

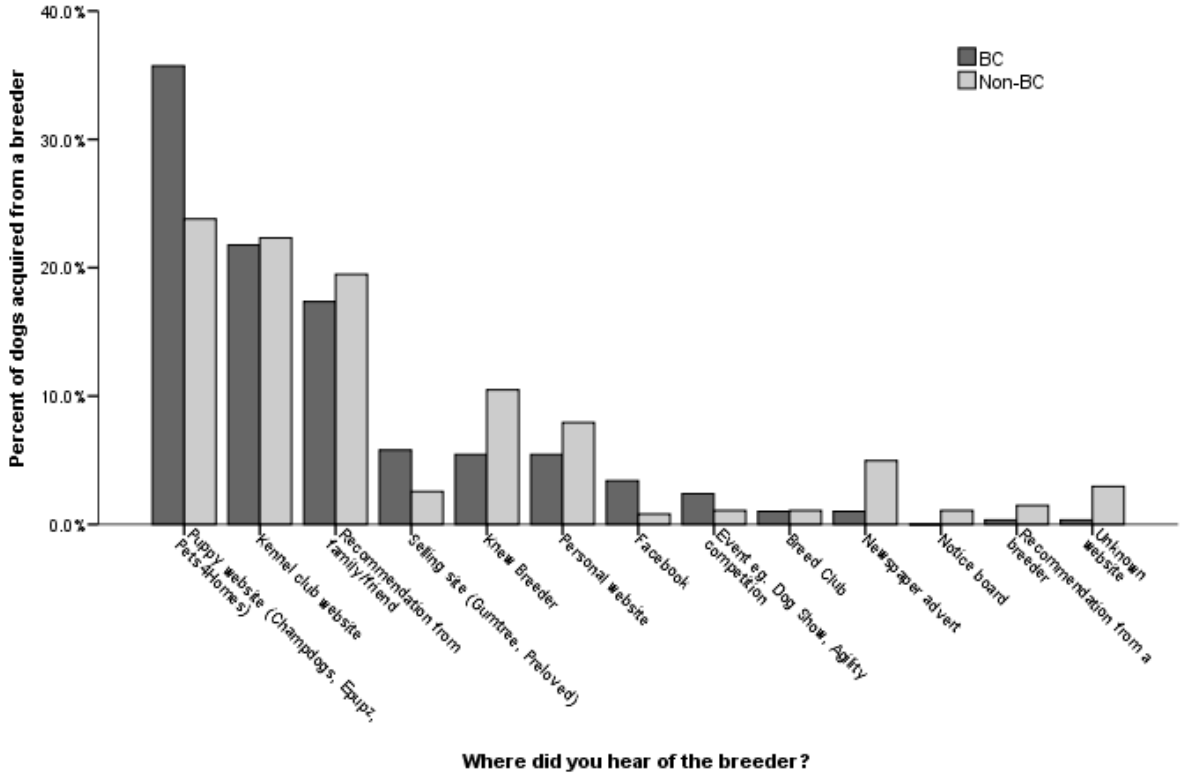
Source of dog	**N**	**%**
Breeder: Kennel Club Registered Breeder (non-ABS)	593	41.6
Breeder: Kennel Club Assured Breeder (ABS) Scheme	192	13.5
Not stated	173	12.1
Breeder: Non-Kennel Club Registered Breeder	168	11.8
Rehoming centre	170	11.9
Breeder: Unknown type	112	7.8
Bred their own dog	11	0.8
Pet shop	8	0.6

726

727

728 Figure 1 Owner reports of where they hear about the breeder of their dog, in the sub-

729 population of dogs purchased from a breeder (n=1065)



730 Table 6 Pre-purchasing questions in BC and non-BC dog owners
731

Question	Answer	Overall	BC	Non-BC	X^2	P	P-adjusted
Did you ask to see health records of the mother and father of your dog?	No	46.1	47.2	45.7	15.16	0.002	0.0048
	Father only	0.4	1.0	0.1			
	Mother only	6.7	10.3	5.2			
	Mother and Father	46.8	41.4	48.9			
Were health records available for the mother and father of your dog?	No	6.8	10.5	5.4	24.30	<0.001	0.0027
	I don't know	28.9	28.9	28.9			
	Father only	0.5	1.0	0.3			
	Mother only	7.4	11.5	5.8			
	Mother and Father	56.4	48.1	59.6			
Had the parents undergone any genetic testing before breeding?	No	8.1	6.3	8.7	16.19	0.006	0.012
	I don't know	43.3	47.0	41.8			
	I don't think there are any genetic tests for this breed	2.0	0.7	2.6			
	Father only	2.5	4.9	1.6			
	Mother only	1.6	1.7	1.5			
	Mother and Father	42.6	39.4	43.8			
Had the parents undergone any other health tests (e.g. X-rays) prior to breeding?	Yes	25.5	20.3	27.5	6.28	0.043	0.0712
	No	10.9	10.3	11.1			
	I don't know	63.6	69.4	61.4			

732